Texas Highways

September, 1958 35c

HIGHWAY SIDELIGHTS

Gordon K. Shearer, Director of Research
Texas State Parks Board

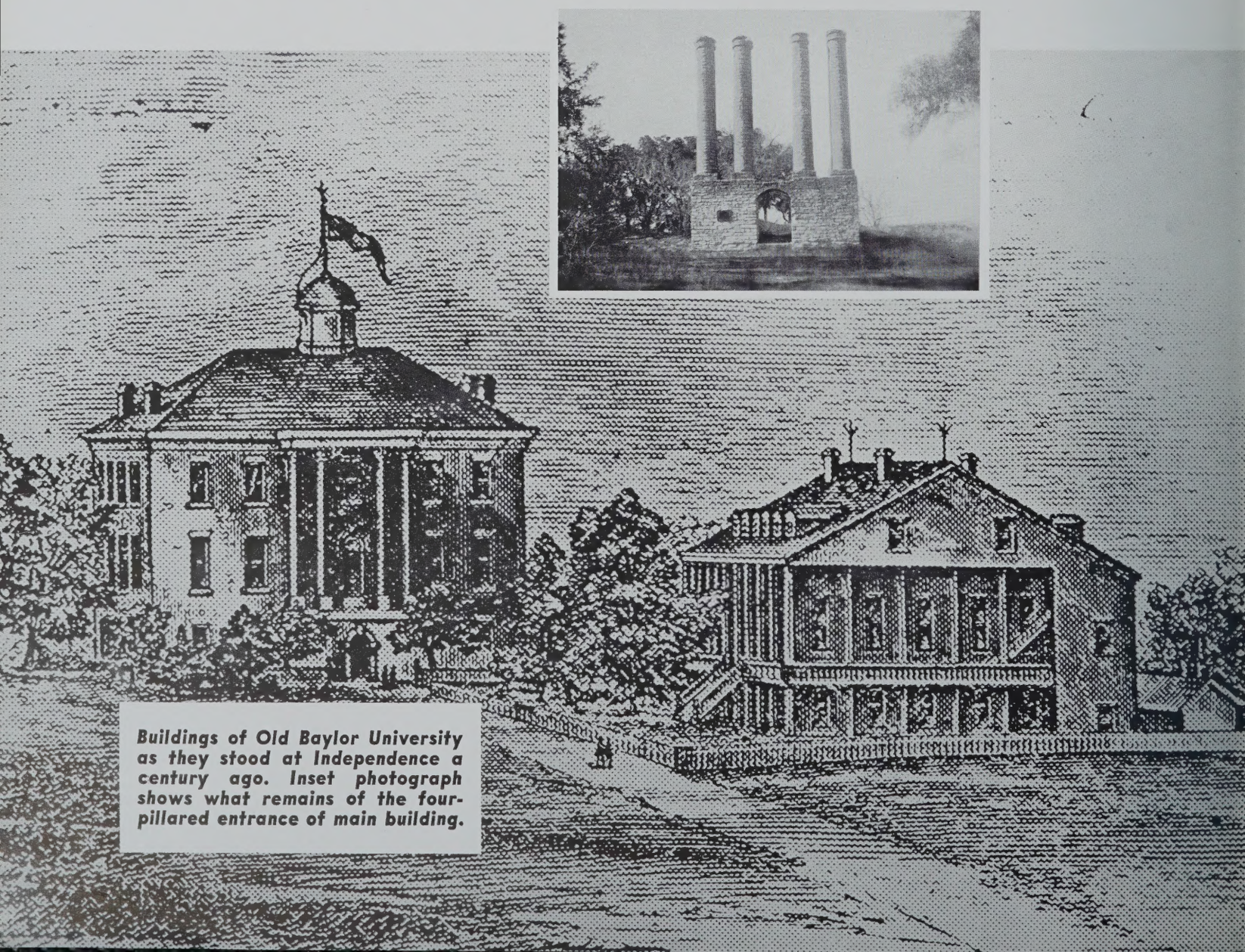
Old Washington, birthplace of the Republic of Texas, and Old Independence, birthplace of Baylor University, are now thirteen miles closer together by automobile travel. Formerly it was necessary to drive almost to Brenham from either to get to the other. A direct road has been opened between Old Washington on State Highway 90 and Independence on Farm Road 50. Both historic places are sites of state parks.

At Old Washington there is a replica of the smithy in which the Republic of Texas was born. The restored home of Dr. Anson Jones, last president of the Republic of Texas, also is there.

Dominating the old Baylor campus at Independence are the pillars of the original administration and classroom building. Foundations and some walls of the original girls' dormitory, the old college well, and remains of a cook room and storehouse are preserved. Both male and female departments of Baylor were at Independence until 1886.

At Independence, too, is the Baptist church where General Sam Houston was converted and worshipped. The original church was adobe. It burned and was replaced by the present stone church in 1872. Services are still held in it.

Nearby is the home of Mrs. Nancy Lea, mother-in-law of General Houston, and of her daughter Margaret, who married the General. Both are buried within sound of the church bell which was cast with silver from Mrs. Lea's tableware. Other interesting homes at Independence are the Toalson House, which antedated the Republic; the Seward house, marvelously restored; the Robertson house, and the home of Dr. Asa Hoxie. All are splendidly preserved examples of early Texas residences.



Buildings of Old Baylor University as they stood at Independence a century ago. Inset photograph shows what remains of the four-pillared entrance of main building.

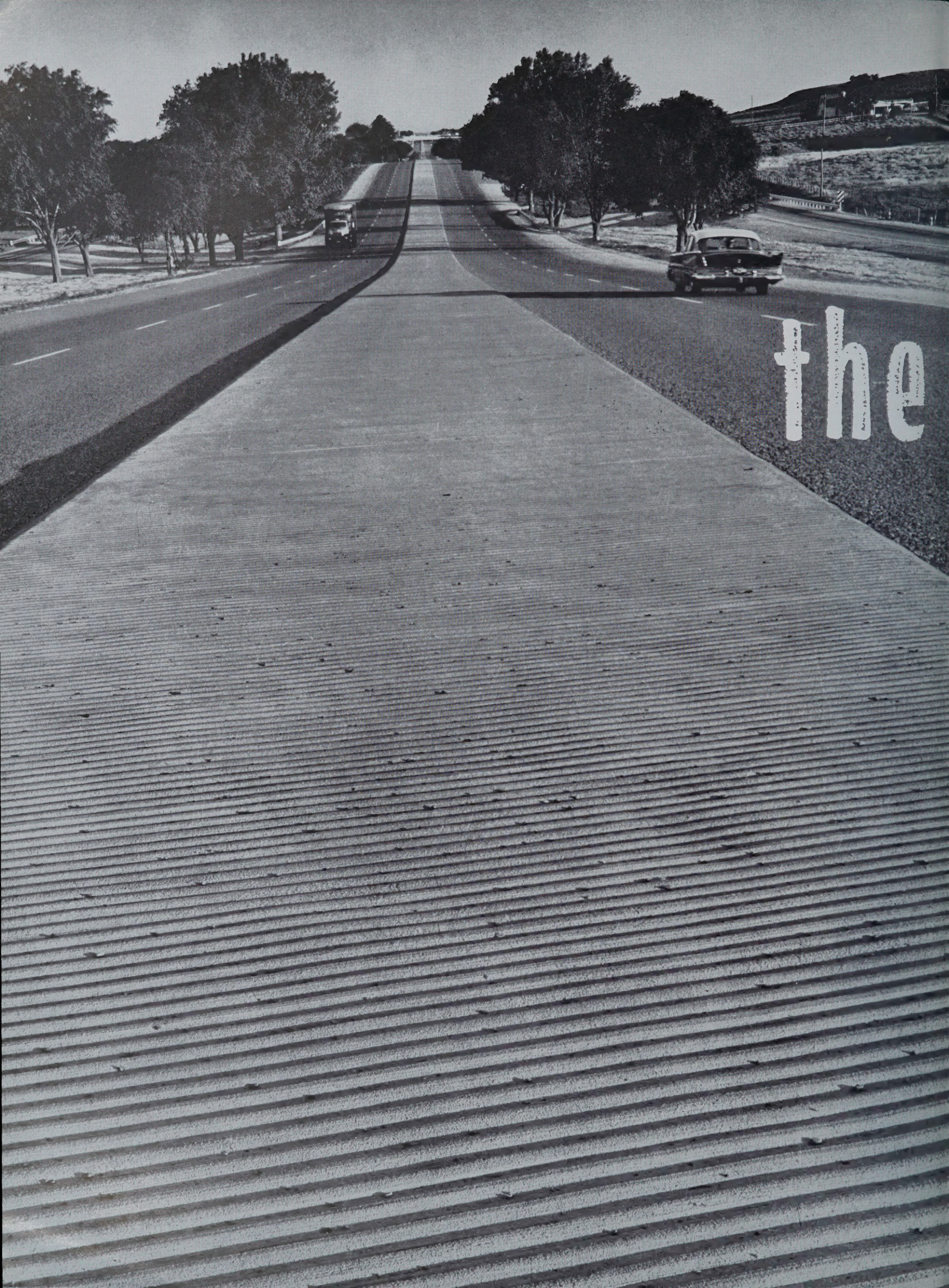
Texas Highways

Volume 5 • Number 9

September, 1958

Contents

The Singing Median	2
Mechanic's Stand and Workbench	6
Slip-form Paver	7
A Rush Job	11
Radios at Work	14
$10,000 Design	18
New Materials and Tests Building	20
Have Gun, Will Shoot	25
Signing Improvement Creates Problems	29
Over the Highways	31


the

singing median

Lyndol B. Carter, Resident Engineer
District 4

Should you doze or daydream and drift off the driving lane and onto the median of U. S. 60 and 87 just north of their junction at Canyon, Texas, you would be startled back to consciousness by a sound—coming from around and underneath your car. After a split second, you realize that the old heap isn't falling apart. The Texas Highway Department has given you a gentle reminder, in the form of the new singing median, to move back into the driving lane because you were drifting into "no man's land," heading for danger.

At times we become distracted from our driving, whether to correct a child, pick up something that slid off the seat, or to look out the window at an unusual, beautiful, or breath-taking scene (quite common on the highways in this area). At such times, we need a warning. Too often, the screeching of brakes and the grinding explosion of metal are the result of permitting our thoughts to wander for a second.

On a mile-and-one-half section of the Amarillo - Canyon Expressway, where the highway divider median is restricted to a narrow width of thirteen feet in utilizing an existing section of pavement, we have tried to incorporate this additional feature along with the regular requirements of a highway divider median. The highway in this area is a divided four-lane facility with an asphaltic surface on a concrete-pavement base, paved shoulders, and 24-foot frontage roads. The highway cuts across a shallow valley with winding creeks and small lakes. Large, shady elm trees separate the expressway lanes from the frontage roads.

The section of median is a thirteen-foot wide by three-and-one-half-inch high corrugated surface concrete median with mountable sides. Burette H. Balfour, of the Road Design Division in Austin, is given credit for the suggestion of this type median.

The singing, or roar, is the result of the wheels of the vehicle coming in contact with the corrugated surface of the median. The magnitude of the roar varies directly with the speed of the vehicle; thus, higher speeds produce a louder roar. Since a highly visible median is a necessity, corrugations were placed at a fifteen-degree angle with the perpendicular to the path of the median (a fifteen-degree right forward skew). This gives better reflections of light since the corrugations are nearly square with the path of a vehicle changing lanes to pass.

A feature noted after the section was completed is that the slant of the corrugations gives a slight returning action. This action tends to return a vehicle to its regular driving lane. The force is not of enough magnitude to cause any discomfort in controlling the vehicle. If the steering wheel is held fixed and the angle of approach onto the median is not too great, the vehicle will go onto the median and then return into the original lane in a matter of a few hundred feet. The fact that the me-

The thirteen-foot divider along a mile-and-a-half section of the Amarillo-Canyon Expressway sings a warning song to motorists straying out of their lane.

Height of the median strip is three and one-half inches—high enough to keep drivers from using it unnecessarily, but low enough to allow access when necessary.

dian is three and one-half inches higher than the pavement also contributes to this action.

Although, at first glance, one might think the side slopes of the median are too abrupt, this has proven quite satisfactory. It is steep enough to discourage use of the median as an additional traffic lane, but when it is necessary to drive onto the median there is only enough of a bump to make one aware that he has climbed onto something.

The section satisfies the regular requirements of a median in that:

1. The median should separate opposing traffic streams without causing loss of vehicle control when it comes in contact with the median out of negligence or necessity.

2. The median should be of such a nature that it will provide a haven in case of emergency.

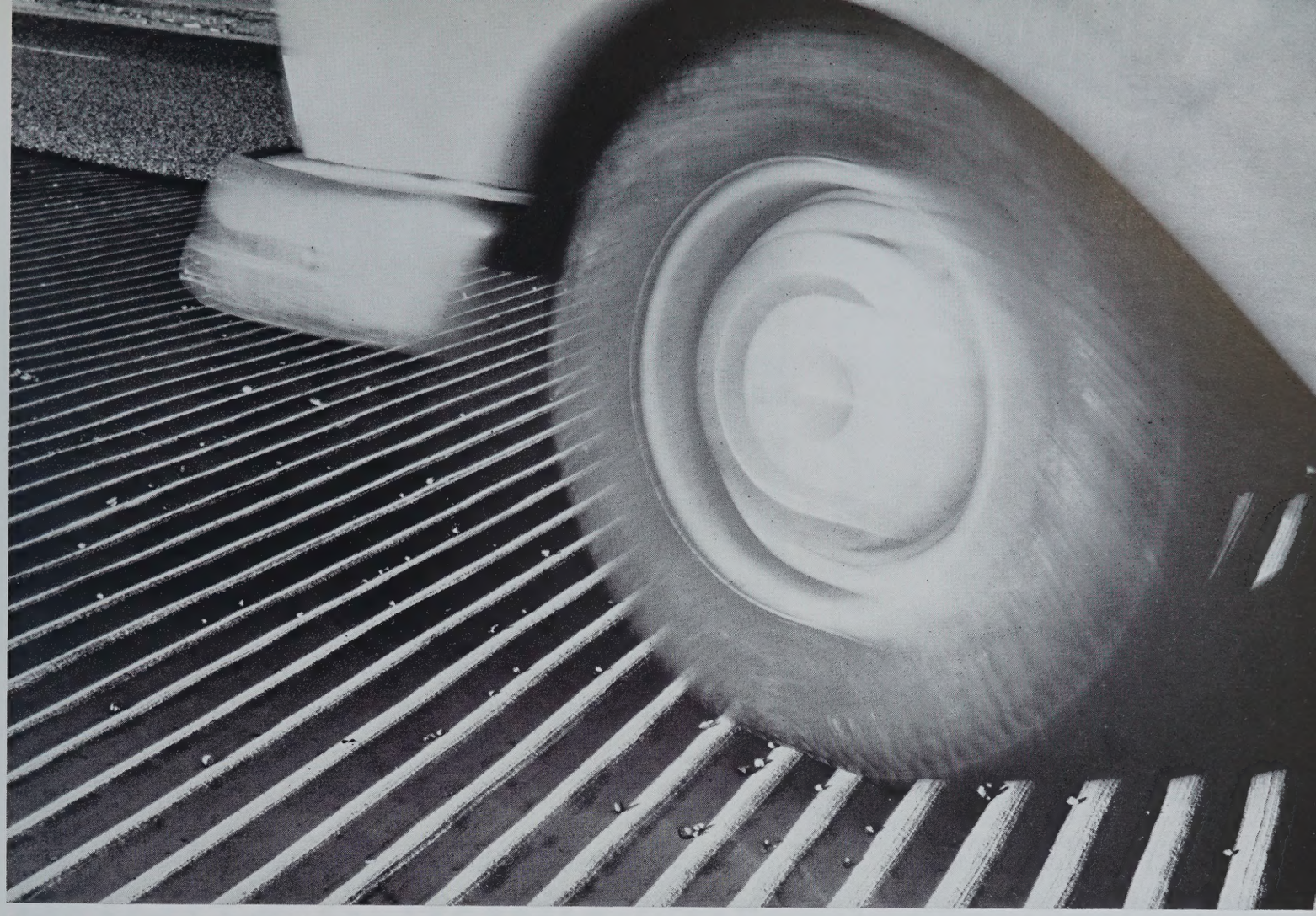
3. A highly visible median both day and night is of prime importance, definitely in contrast with the pavement lanes.

A median of this width will also allow for the addition of a barrier fence down the center should it become necessary.

Ivan Dement was the General Contractor for construction of this section of the Amarillo-Canyon Expressway, under the supervision of Byron Reese, Expressway Engineer, and George Schlinkman, Senior Resident Engineer, for the Texas Highway Department.

The Contractor elected to use a sliding metal form. This form was about fifteen feet long and was pulled by a winch mounted on a truck. The form ran on two-inch by six-inch oiled lumber which was laid flat and spiked into the existing asphalt surface. At the front of the form was a section to receive the concrete (transit mix trucks were used for the concrete). Mounted with the receiving section were two mechanical vibrators to obtain necessary compaction. Next was a set of shaping or strike-off blades built into the form. The next platform was for two men using "jitterbug" grill tampers to bring enough grout to the surface for finishing. The final set of shaping blades were mounted on the end of the form. Concrete came out properly shaped and smooth.

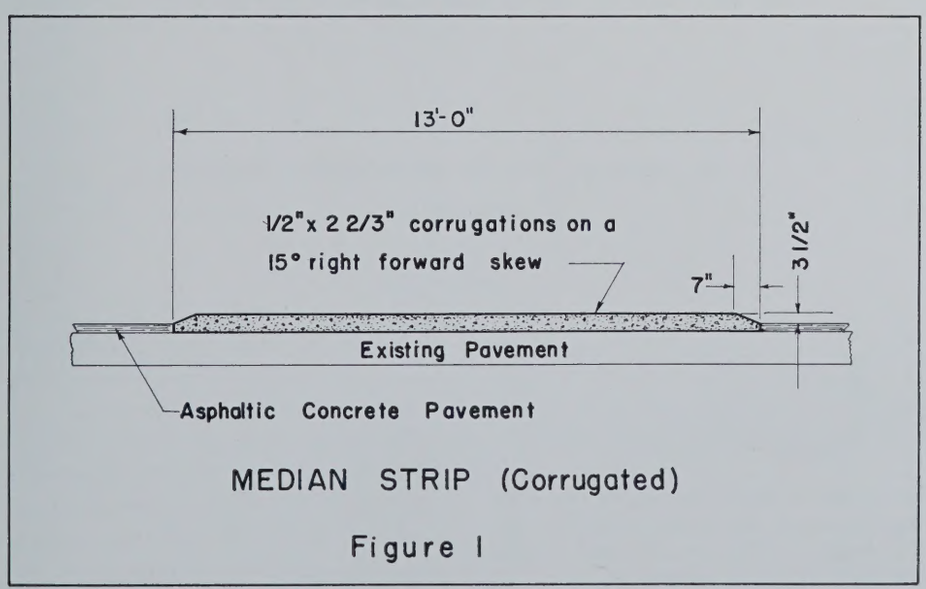
At the start all concerned were somewhat apprehensive as to the method for obtaining the corrugated surface. However, the problem worked itself out satisfactorily and without any excessive difficulties. Directly behind the form, corrugations were formed by a finisher using a long handle bull float (or mop) with a corrugated pad in lieu of the standard smooth float pad. A two-inch by four-inch guide was set for the first pass with the float to obtain correct



The singing sound occurs when the wheels of a moving vehicle come in contact with the corrugated surface of the median.

corrugation skew; thereafter, the outside corrugation on the float was run in the last corrugation of the previous pass. The size of the float pad depended on the size of the finisher operating it. A fairly wide and heavy pad seemed to form the corrugations better and create less work in the long run. Across and back was usually sufficient.

Following this, two finishers touched up and edged the sides. Next came another finisher with a long-handled corrugated float. It stayed far enough back to allow the concrete to take a firm set. This pass was primarily to fill air holes and to spread the grout again. Following was the brush finish. The same finisher operated the second bull float and brushing operation. Membrane curing was then applied, completing the operation.



MEDIAN STRIP (Corrugated)

Figure 1

Redwood expansion joints were used and placed to coincide with the expansion joints in the concrete pavement base. Some spalling developed because of a few redwood joints being placed low or being knocked out of alignment by the sled.

Pay for the median was by the cubic yard of Class "A" concrete (median strip corrugated). The quantity of concrete required in this section resulted in a rather expensive item. Only time will determine the justification of cost—but just what is the value of a life saved?

The extra height attained by this mechanic's stand makes the engine more accessible to the man working on the truck.

Another stand used is this one which hangs on the tire.

Mechanic's Stand and Workbench

R. N. Jennings, District Maintenance Engineer
District 7

The stand is held steady by the two legs nearest the truck. Casters on the legs of the workbench make the unit easy to move.

Mechanics in District 7 were having difficulty in reaching the engines of trucks to work on them because of the height of present-day vehicles.

W. A. Vannoy, Senior Equipment Supervisor for the District, devised a combination workbench and stand which makes work on high trucks much easier.

More on the

Slip-form Paver

Lawrence Galfione Jr., Resident Engineer
District 12

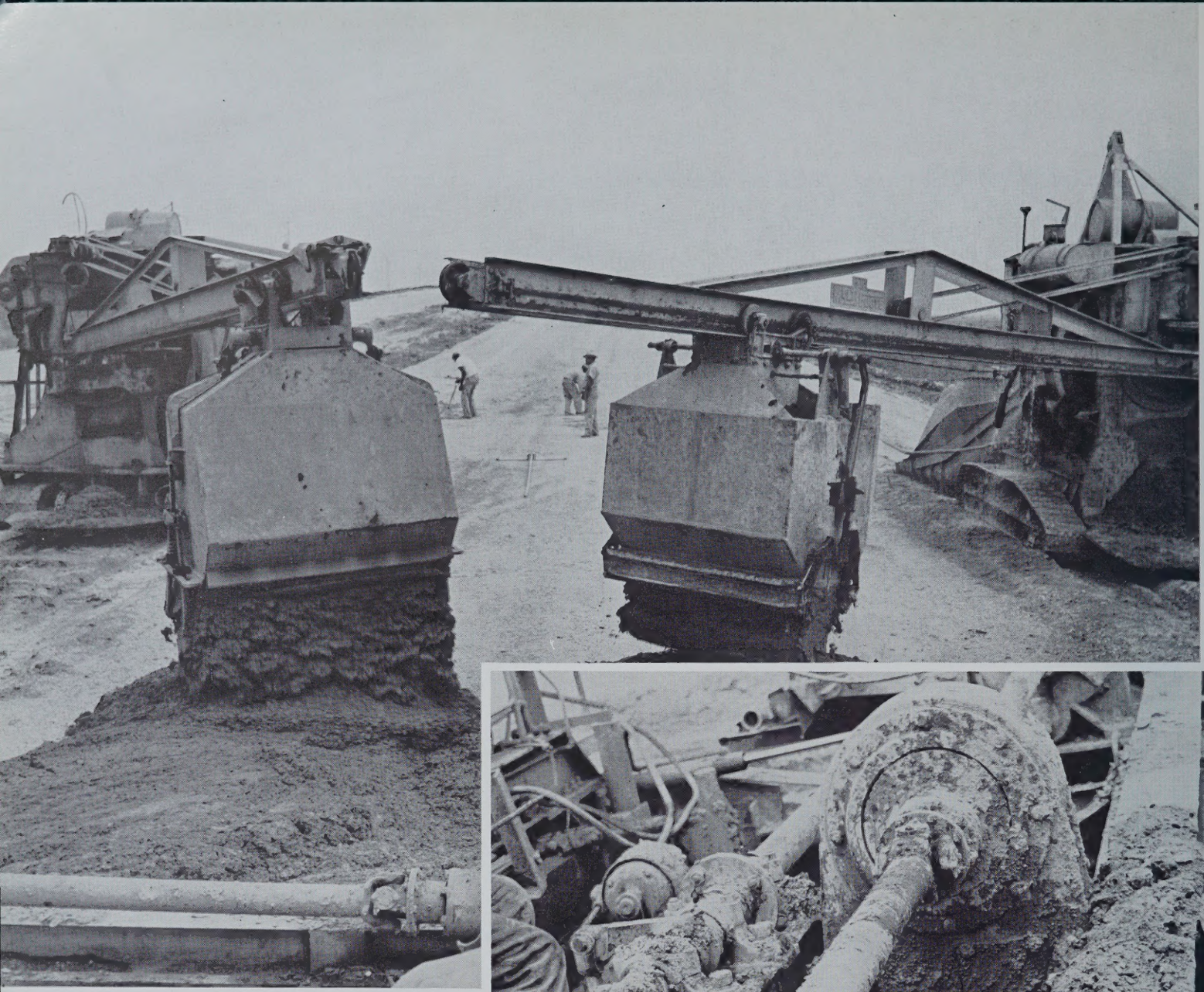
The slip-form paver, most revolutionary piece of equipment to enter the highway construction industry since the advent of the heavy earth-moving machines, recently completed placing 72,000 cubic yards of shell-concrete base on a section of Interstate Highway 10, formerly State Highway 73, in East Harris County.

The project extends from 0.9 mile east of the Lynchburg-Crosby Road to Cedar Bayou, a distance of 8.3 miles, and consists of a four-lane divided trafficway of two twelve-foot lanes in each direction. The thickness of the shell-concrete base is twelve inches. Surfacing will consist of hot-mix asphaltic concrete applied at the rate of 100 pounds per square yard.

The slip-form paver operates at a maximum speed of four feet per minute and is equipped with 64 feet of trailing forms to allow the concrete to obtain sufficient set to avoid edge slumping as the machine moves forward.

Control of bleeding is vitally important in the successful use of the slip-form paver and is achieved by careful gradation of the aggregates, the use of 4 per cent added air, and the production of a uniform batch through moisture control in the aggregates and at the paving mixer. Substantial surface bleeding, with subsequent lateral flow due to the pavement crown, will cause edge slumping and will require form setting behind the paver. Also, profuse side bleeding will wash the mortar from the coarse aggregate, leaving a honey-

Paving operations move forward—without forms.



Two paving mixers feed the slip-form paver.

combed condition which requires patching. The occurrence of side bleeding may or may not cause edge slumping, depending upon the amount of surface bleeding occurring at the same time. Where substantial bleeding occurs, strong wind action will shift most of the surface moisture to the leeward side of the pavement, causing edge slumping to be more prevalent on that side. Paving during warm, dry weather will reduce the amount of edge slumping due to the evaporation of some of the surface moisture. Conversely, periods of overcast and of high relative humidity

This close-up shows the reversible auger, or screw-type spreader.

will add to the form setting behind the paver. However, edge slumping, regardless of the evaporation or humidity, will be negligible if bleeding is controlled and a uniform batch of the desired slump is maintained.

It was found that a water factor of eight and one-half gallons per sack, a shell or coarse-aggregate factor of 84, together with a specified cement factor of five sacks per cubic yard, produced a mix design with the desired slump of one and one-half inches which worked satisfactorily for the project. The fine aggregate was composed of 80 per cent San Jacinto River sand and 20 per cent Colorado River sand.

The subbase for the paving operations is initially roughed in with the use of a maintainer followed by the pulling of a track-mounted subgrade planer over a hand-graded track line just outside each edge of the future pavement. The subgrade planer, equipped with cutting blades two feet long and set to the desired crown, cuts the grade to the exact section. Flat-wheel rolling and watering complete the final phase of the grading operation.

The slip-form paver is mounted on tracks 22 feet 3 inches long, and 8 inches wide. It is equipped with a reversible auger or screw-type spreader which is a new feature added by the contractor, Austin Road Company. Two vibrators attached to a screed and a surface tamper activated by cams insure uniform and dense placement of the concrete. An adjustable finishing screed three feet six inches wide and an oscillating belt two feet wide produce the slab finish. A final hand belting is given the slab after the trailing forms have passed it.

The slip-form paver is driven by electric motors with power supplied by two gasoline-engine-driven generators mounted on the bridge of the paver. An electric motor mounted near each rear sprocket provides for the forward and reverse motion of the machine. The operator of the paver uses a steel pointer mounted on the left side of the machine to follow a two-foot offset tack line to control the alignment of the slab.

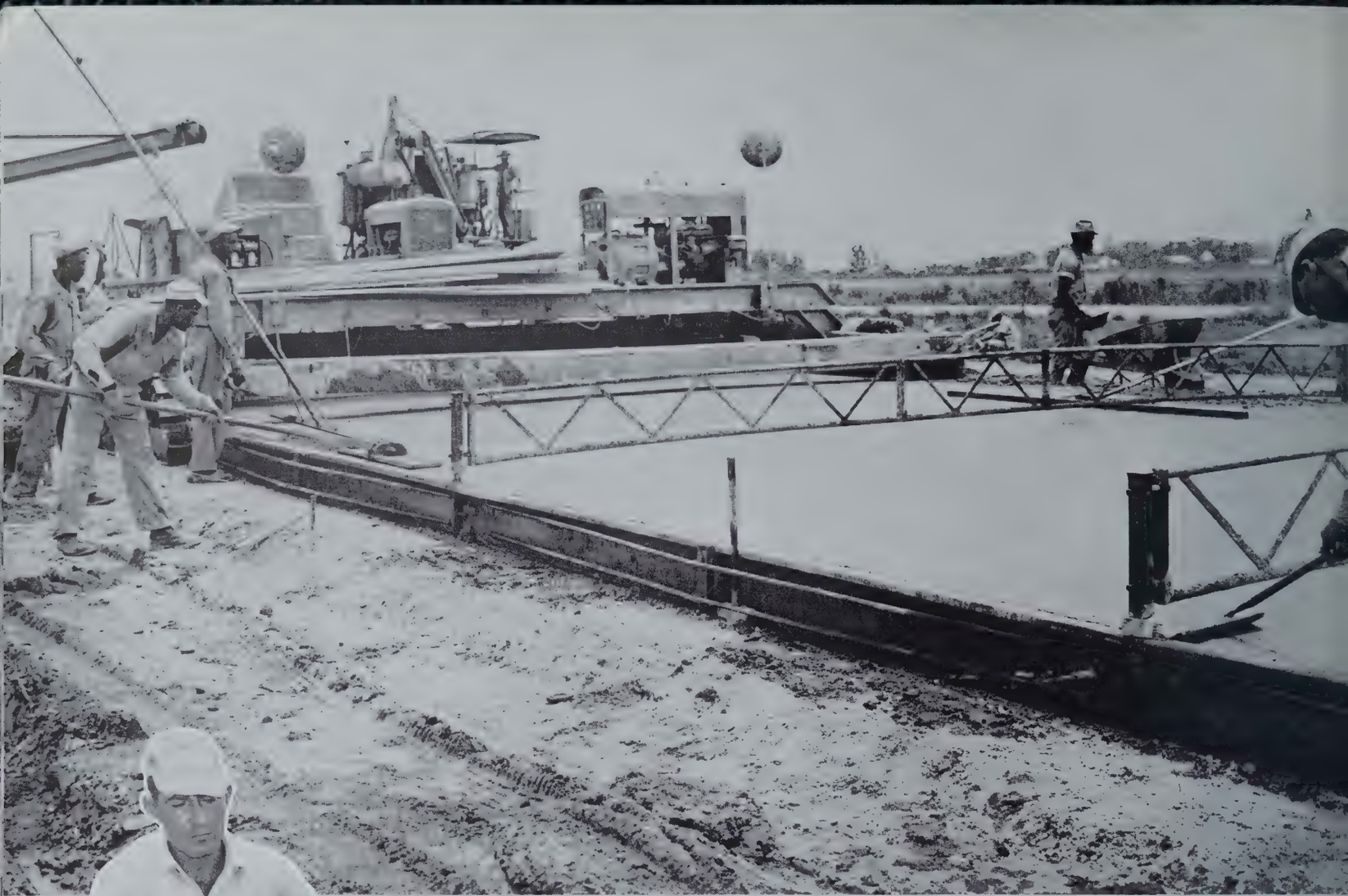
Sawed joints three and one-half inches deep were used on the project. Transverse joints were spaced on eighteen-foot centers. Joints were sawed on the day following each day's pour. The bars on 30-inch centers were placed at the proper depth across the position of the future sawed longitudinal joint during paving operations. The bars were placed between the vibrating screed and surface tamper as the slip-form paver moved forward. Dowels for ramp connections were driven into the side of the slab after the traveling forms passed the location.

Asphalt emulsion was used for curing. A minimum average flexural strength of 450 pounds per square inch at seven days was required. Depth tests were taken at every station from a bridge mounted on the traveling forms.

Maximum gradient on the project was 4 per cent and maximum degree of curvature was two degrees. On tangent sections a crown of one and one-half inches was required. Maximum superelevation in curved sections was .03 foot per foot. The project was interspersed with five grade-separation structures which were incomplete during the period of paving operations, requiring the paver to be turned around a number of times. A 90-foot exception at bridge ends, later formed and poured, allowed for the turning operations on top of the fills.

The slip-form paver was used in

From the front can be seen the auger, vibrating screed, and surface tamper. Notice the operator at the control panel, and the location of the dowel setter.



This rear view shows trailing forms and finishing operations.

« A transverse joint is sawed to a depth of three and one-half inches.

conjunction with one 34 E dual-drum and one 34 E single-drum paving mixer with an average batch haul of four and three-fourths miles. A day's production of 1,800 to 2,000 feet during a twelve-hour work day was not infrequent.

Due to the savings derived from the elimination of the use of forms, form accessories, and transport equipment, and the increased production in making grade with a smaller working crew, the slip-form paver will gain more and more consideration and wider acceptance for use on large-scale projects having constant-width pavement—where other factors are conducive to its use. While yet in its comparative infancy, the slip-form paver has demonstrated an economic potential that is too important to be ignored by cost-conscious highway builders.

a rush job

Ben E. Dillon, Senior Resident Engineer
District 23

F. M. 734 was built in 1949 with 75 per cent county funds and 25 per cent state funds. This road, located along the county road with a low bridge across the San Saba River, was a typical farm-to-market road joining another section at the Mason County line and extending to Pontotoc. In 1950 the section from Pontotoc to Llano was completed. When this last section was completed, it was realized that the road connected two county seats running through four counties. The opening of this road caused traffic to increase to an average of about 100 cars per day.

About this time, R. M. 93 between Llano and Austin was being planned, and short sections were put under contract. It was completed in 1953 and later marked as State Highway 71. At the opening of this road, the counties of Llano, Mason, San Saba, and McCulloch were told to get ready for a rebuilding program on F. M. 734 from Llano to Brady. The people of McCulloch County were anxious to get a new state highway coming into Brady, but with 54 miles to rebuild they knew it would be a long, hard struggle. The thing that McCulloch County was worried about was which section to build first.

Then the tragedy happened. On April 29, 1956, a car was swept off the low-water bridge, drowning three people in a flash flood in Mason County on Katemcy Creek three miles above the low-water crossing.

With public sentiment from San Angelo to Austin, and the cooperation of the State Highway Commission, Minute Number 40165 was passed on May 22, 1956, authorizing the State Highway Engineer to build

The old county bridge stands alongside the low-water bridge.

In 1956, a car was swept from this low-water bridge during a flash flood, drowning three people.

These floodwaters led to the building of a new high-water bridge over the San Saba.

Floodwaters recede to show the damage done.

Completed in March of 1958, the new bridge has a 28-foot roadway. Total cost was $436,000, not including engineering.

a high-water bridge on the San Saba River. The McCulloch County Commisioners Court accepted the minute on May 29, 1956. The Investigation and Planning Expense was approved June 12, 1956, and field work started June 13, 1956.

Plans for the new bridge and four miles of road were completed and sent to Austin on November 19, 1956. This job included a 900-foot bridge across the San Saba River and a 200-foot bridge across Tiger Creek. The San Saba River Bridge, designed by the Bridge Division, consisted of two 330-foot continuous I-Beam units with four 40-foot pan girder units on the north end and two 40-foot pan units on the south end. This bridge has a 28-foot roadway with twelve-inch channel railing, and is 52 feet above the flow of the river. The roadway is designed for 60 miles per hour with 24-foot pavement and six-foot shoulders.

Total cost for this project was $436,000, not including engineering. The contractors were M. E. Worrell and Border Construction Company.

There was a 23-month period from the time of the tragedy to the opening of the road.

To some this might not seem a rush job, but it must be remembered that everything started from scratch. Steel delivery was being quoted from twelve to sixteen months and one month was lost due to steel delivery.

I personally want to compliment representatives of D-5 and D-14 for their cooperation in expediting this project.

We received an excellent rating for this project on completion by E. M. Pritchard, Assistant District Engineer.

in District 12

Radios at Work

Now that two-way radio units are a way of life in twelve of our districts, all districts are familiar with their operation. By July of next year, the remainder of the districts will have radio units installed, or in the process of being installed.

District 12, one of the first to receive radio units, finds many uses for them. Pictured are activities involving use of the two-way radio in the Houston District.

The antenna for the main station, District 12, tapers skyward . . . a focal point for radio beams within a 45-mile radius.

Taking an incoming radio call is George M. Seelke, Junior Equipment Supervisor, District 12 shops. Maps in the background permit fast locating of crews.

Roy Estes, Supervisor, Causeway Control Tower, notifies a field crew of a wreck site. His routine work is also facilitated with the new communications system.

Shipmaster William J. Standley tends the tiller aboard the Port Bolivar Ferry while communicating with shore.

While making his rounds in the District, Arnold Vyvial, Construction Foreman, Houston office, discovers breakout — probably caused by inclement weather — and calls maintenance warehouse for a repair crew.

Carrying out the orders to repair the breakout, Hubert Shaddock, Skilled Laborer, reports back to the Alvin warehouse that all is well . . . the job is being done.

The receiver-transmitter set on Shaddock's truck is located in the truck bed.

J. N. Ashcraft, Senior Maintenance Foreman, alerts mechanic John H. McMicken of a broken-down Gradall's location.

Moser the tal replace out ligh

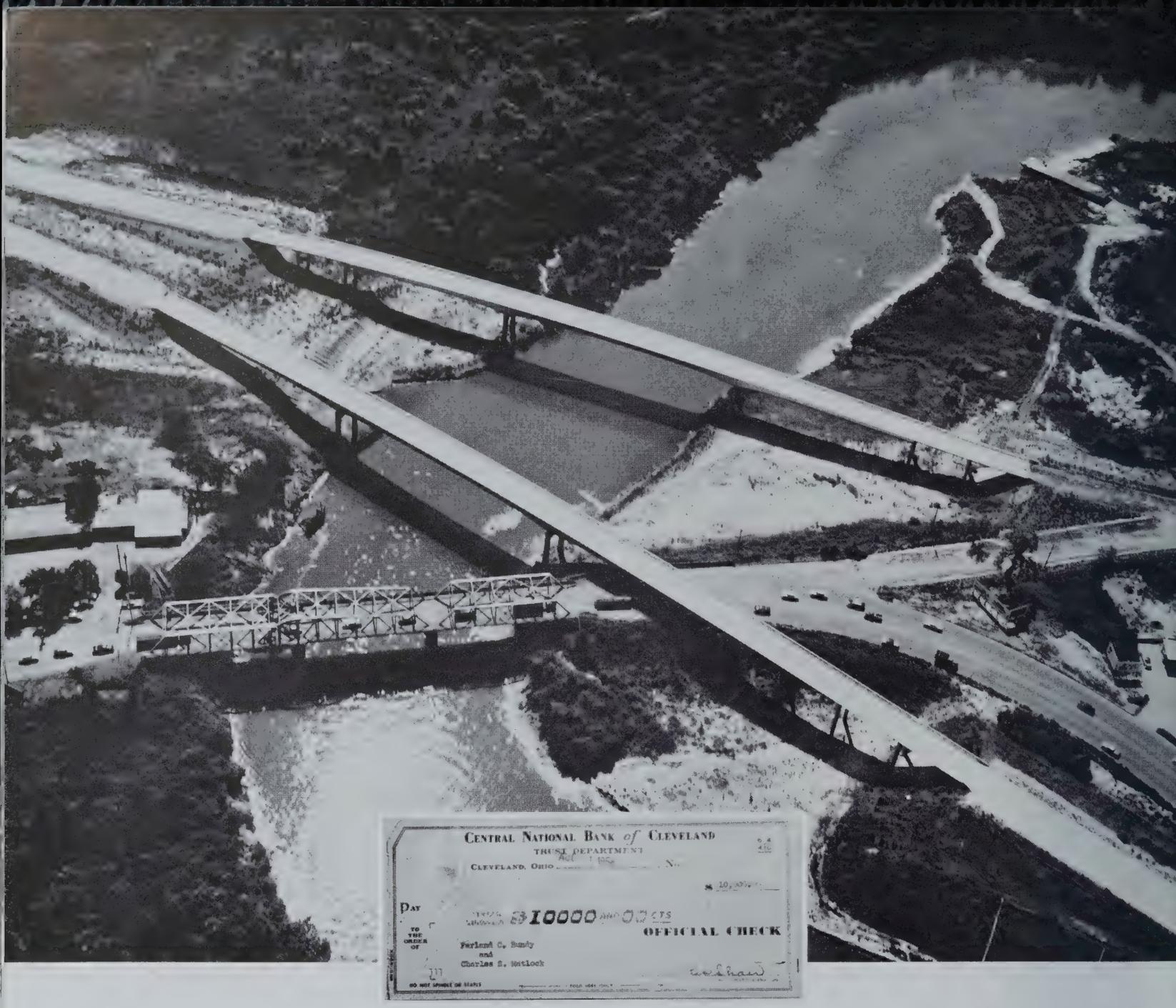
"The trouble is . . ." points out Ashcraft to McMicken.

Helen Cecil, Junior Clerk, monitors all calls that come in to the District 12 office, then channels them to proper quarters for handling.

seys up ower to burned- ulb.

Tool in hand on another job, McMicken receives the call from Ashcraft at his truck, ready to move on to the next job.

Freddy W. Moser, Skilled Laborer at Hitchcock Base Station, sounds off over the two-way radio to one of the field crew.



$10,000 DESIGN

To most of us, it never happens in a lifetime, not even once. It sounds a little like "Sixty-four Thousand Dollar Question" with some "Twenty One" thrown in. The next best thing to having it happen to you is to know someone it happens to.

In this instance, Charles S. Matlock and Farland Bundy, Senior Designing Engineers with the Bridge Division, are on the receiving end.

When the news arrived, word spread like wildfire throughout the main office of the Highway Department in Austin—all the more exciting because the principals were out of town and didn't even know anything about it.

"It" was a $10,000 check that went with the First Award in the James F. Lincoln Arc Welding Foundation competition. Matlock and Bundy received the award on the basis of

« ***This is the bridge responsible for the award—the Sixty-ninth Street Bridge over Buffalo Bayou in Houston.***

the design of the recently completed Sixty-ninth Street Bridge over Buffalo Bayou in Houston.

The two men were in Houston on business, and were notified by phone by Randle B. Alexander, Bridge Engineer. They got the word hours after everyone on the sixth floor of the Highway Building heard the news.

Awards in the competition go to designers of outstanding bridges of welded construction for interstate and defense highways. The design of the Buffalo Bayou Bridge was entered in the competition along with bridges throughout the nation. The 668-foot structure is described as "one of the longest welded bridges" and a bridge on which "unit prices bid were among the lowest." This latest award came close on the heels of a 1957 award for the most beautiful steel bridge erected last year. (See October, 1957, TEXAS HIGHWAYS.)

Farland Bundy

Charles S. Matlock

Bundy admires the check he and Matlock received along with the First Award in the James F. Lincoln Arc Welding Foundation competition. Neither gentleman looks unhappy about the whole thing.

Matlock and Bundy have twelve and ten years respectively with the Department. A native of Tyler, Bundy holds the degrees of bachelor of arts in applied math, and master of science in civil engineering from The University of Texas. Matlock, of Floresville, holds a degree of bachelor of science in civil engineering from The University of Texas.

As to what these men of newfound wealth will do with the money —both plan to pay off Uncle Sam, spend a little, and save a lot.

This is not Bundy's first time to be among the winners. In October of 1952, he and Milton D. Randall, then with the Bridge Division, won honorable mention in this same competition.

Another Highway Department employee, Douglas A. Nettleton, Supervising Designing Engineer in District 18, was one of the winners of a Second Award amounting to $7,500.

New Materials and

Lower away! The giant 400,000-pound universal testing machine drops into place at the building site, March, 1957. That's all it is at this point—the fill is in but slab hasn't even been poured. The walls of the building were built around the testing machine. «

The first splatter of concrete for the Materials and Tests Building hits the ground on May 29, 1957. »

Tests Building

Materials and Tests Division moved into new quarters in April of this year, and like other new-dwelling occupants, has received a steady flow of building-viewers on the premises.

Visitors to the attractive, modernistic, one-story building located at Camp Hubbard in Austin, enter the reception and switchboard area through a patio. The operator contacts staff personnel by telephone or by intercom, and the visitor can relax in one of the comfortable blue chairs while waiting.

A glance at the wall behind the switchboard lists the affiliations and memberships in national organizations of Materials and Tests, white letters standing out plainly against the dark paneling of the wall.

The small framed plaque on the wall merits a careful reading, too, for it is the foundation idea of the operations conducted by the division. The statement reads "One test is worth a thousand expert opinions."

If the visitor wishes to make a call while waiting, there is a white telephone at one corner of the reception counter.

On the left-hand wall of the reception room hangs the commemorative plaque giving the information that the building was erected in 1957 with Marshall Formby as Chairman of the State Highway Commission; Herbert C. Petry Jr. and Charles F. Hawn as Members of the Commission; and D. C. Greer as State Highway Engineer. Architects for the building were Page, Southerland, and Page; and Jessen, Jessen, Millhouse, and Greeven. Also listed are the names of the contractors. General

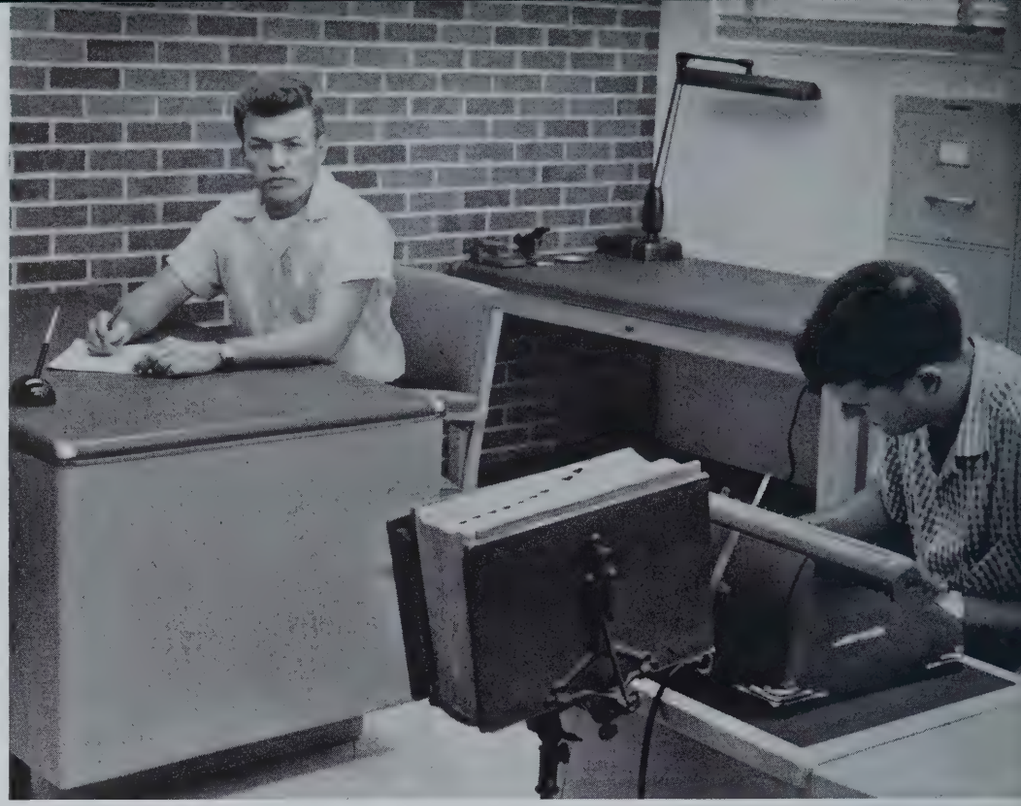
A. W. Eatman, Materials and Tests Engineer, moved into the new bailiwick along with the 125-member D-9 staff in April of this year.

Main entrance to the building is through the plate-glass doors to the right. Administrative offices are to the left of the switchboard area; laboratories, down the hallway to the right.

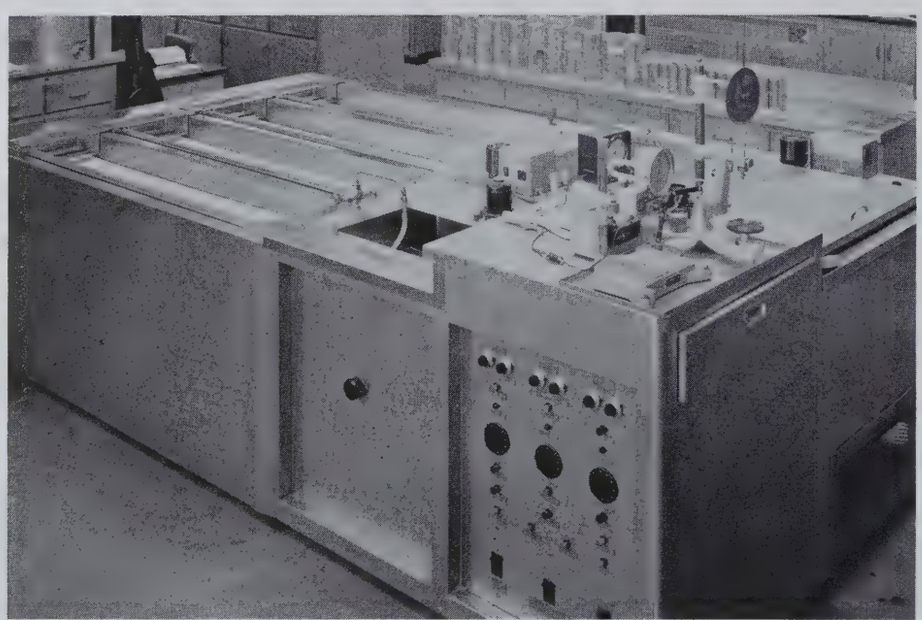
Nancy T. Cole, Laboratory Clerk, is ready to do a paging job over the intercom. The panel at the lower right-hand corner is a counterpart to the switch panel in the office-wing hall. A glance to the right tells her who is out or in his office.

Contractor was the M. Z. Collins Construction Company. Mechanical Contractors were C. G. Puryear, H. L. Arnold Company, Inc., and Seco Smith Electric Company.

Perhaps the visitor will be interested in a few statistics about the building. If he is, he might like to know that the administrative offices and the laboratories cover 35,000 square feet of floor space. It might disturb him for a minute to know that there are no foundation piers under the building, but he will be reassured when he learns that the fill material underneath the concrete slab is compacted and sturdy. This is the same kind of fill that is used for the highways of the state. The slab-on-fill feature made the building cost one dollar a square foot less than the usual cost of such construction. The price



Kenneth Sandberg, Field Engineer, and Robert Richardson, Inspector, enjoy the office space provided in the building for field personnel. Work tables, files, and office equipment are aids to the report work which is accomplished here. Sandberg and Richardson are with the Field Inspection Group.



The four-bath ductility machine in the asphalt and chemical laboratory was designed and built by Highway Department personnel. As many as eight tests (to measure the elasticity of asphalt) can be run at one time. The special water used in the test goes into reservoirs beneath the tanks, is stored and reused. When the specific gravity of the water required by the test measures out wrong, it is an easy adjustment to bring it back within desired limits, and a whole new batch doesn't have to be mixed!

Work counters in the distillation room of the bituminous section have storage space underneath all the chemical hot-plates, gadgets, and gizmos seen in the picture. Cabinets throughout the building are wood with stainless steel tops. » All were manufactured in nearby Taylor, Texas, by the Taylor Manufacturing Company.

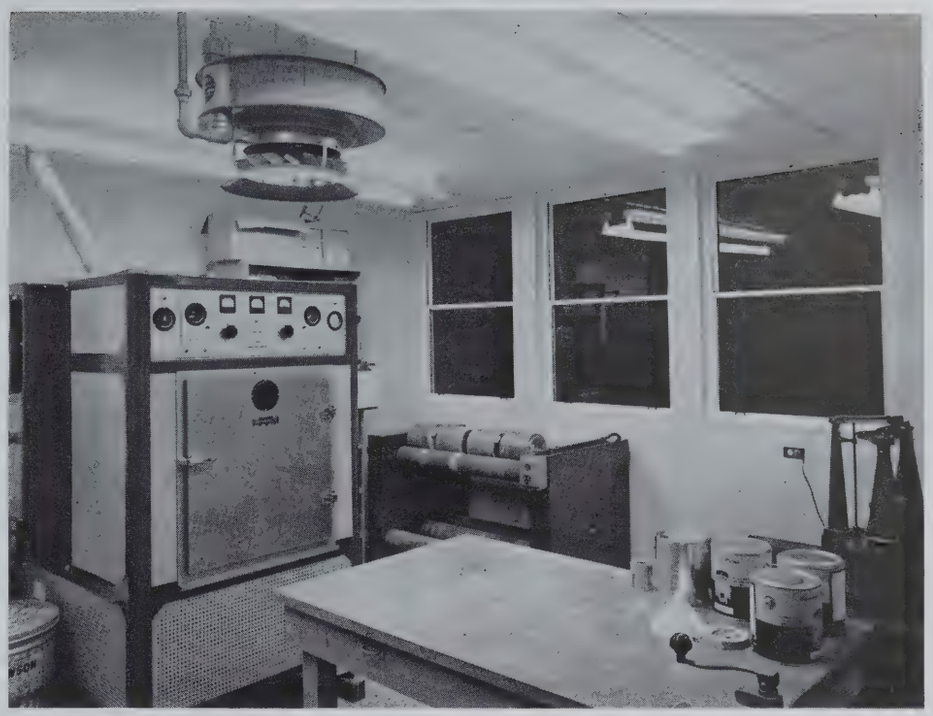
tag for the entire building totaled out at $517,666. This does not include furniture and equipment, which ran the cost up to the neighborhood of some $750,000.

Before building plans were decided upon, Department personnel carefully observed material and testing establishments throughout the nation. No plan exactly met the complex requirements demanded by Texas Highway Department needs. So the building—functional, efficient, and yet spacious, is a product of home-grown design and planning.

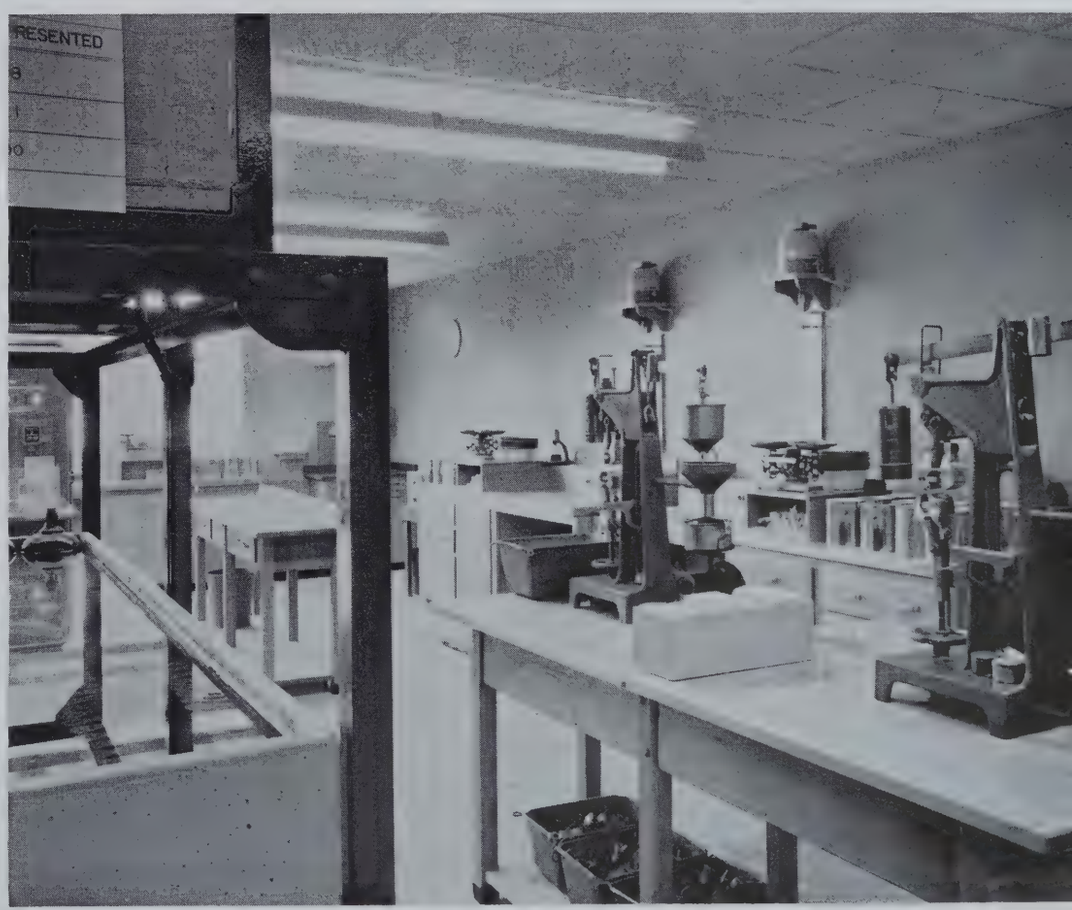
The whole building has a lightweight concrete roof. The roof is a poured one, and the mix for it was pumped up from ground level. There is no roofing insulation other than the light insulating concrete. One feature of the topside covering is that the roof can be removed in two-foot squares in case repair work is called for.

Ideal summer and winter is brewed beneath the roof by 160 tons of refrigeration equipment. The 150-ton chiller is the latest in air-conditioning engineering. The system is centrifugal and costs less to operate than other types of systems. This big unit provides for the general comfort of the D-9 staff. In addition, ten tons of refrigeration equipment are on separate units for year-around control of temperature and humidity in special areas.

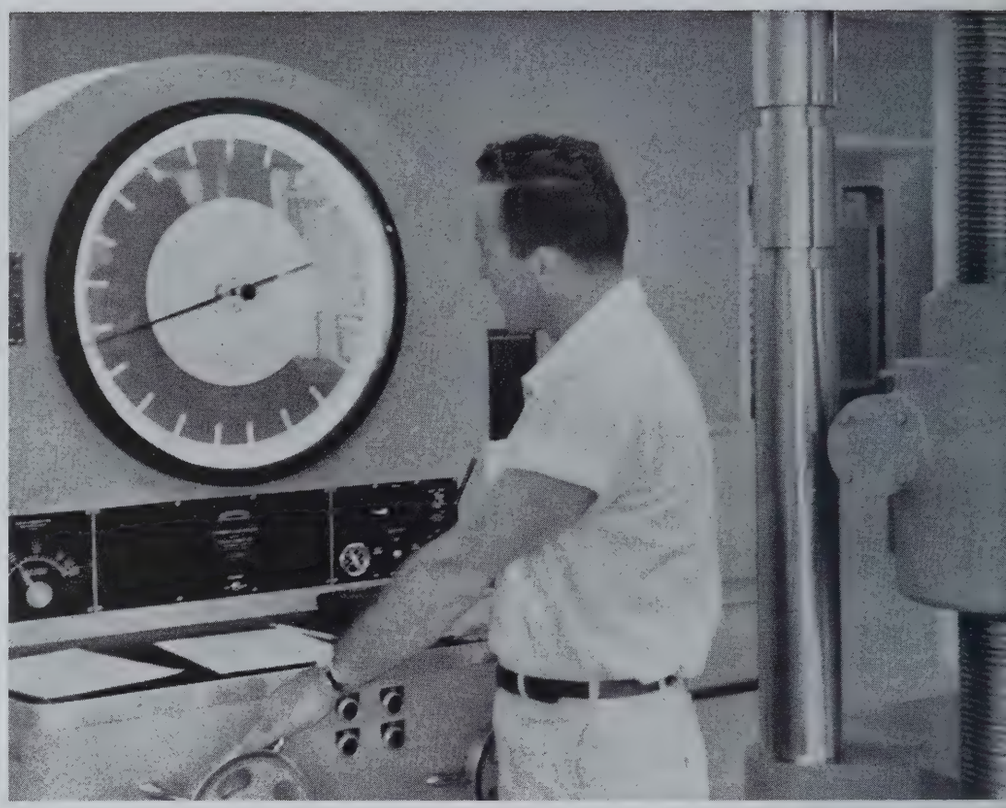
Exterior walls of the building are insulated metal wall panels—the sea blue-green of them repeated in the color scheme of some of the equipment inside. Exterior variegated red brickwork makes a pleasant contrast with the metal wall panels in portions of the building. Interior walls are gyp-lath and plaster, and the off-white ceiling is of acoustical plaster



The oven-like machine with all the dials is the Weather-ometer, where home-made sun, fog, storm, and the like are whipped up to test paint panels. The test is a quick exposure method to determine how the paint is going to react out in the weather. Another room of the paint section is a black-as-night 50-foot tunnel used for testing paint and bead reflectivity.



The water-bath curing tanks at the left were made at Texas Highway Department Shops many years ago, but seemed to have settled to a graceful middle age amid the new cement lab surroundings. Cement section tests about 7,000 samples a year.



Hands on the wheels and eyes on the dial take intense concentration as LeRoy Walker, Laboratory Assistant, watches the needle climb. Recognize the steel cylinders at the right? This is the same testing machine that the building was built around. A giant hydraulic jack, the machine tests steel and concrete cylinders for how much pressure they can stand.

in the office wing, and three-fourths inch Fiberglas in the laboratory wing.

Twenty-eight exhaust fans poke up through the roof, keeping the building well ventilated. There are twelve separate air-handling units to keep the air from the laboratory sections and the offices apart.

A special communications device is in the wall of the office corridor. It has glass-covered slots with office personnel names opposite individual switches, and is similar in appearance to name charts seen in apartment houses. A duplicate panel is at the central switchboard. When a man is going to be out of his office, he switches off his name on the corridor panel; this information is recorded instantly at the main switchboard; and the operator can tell at a glance whether the man is available for calls.

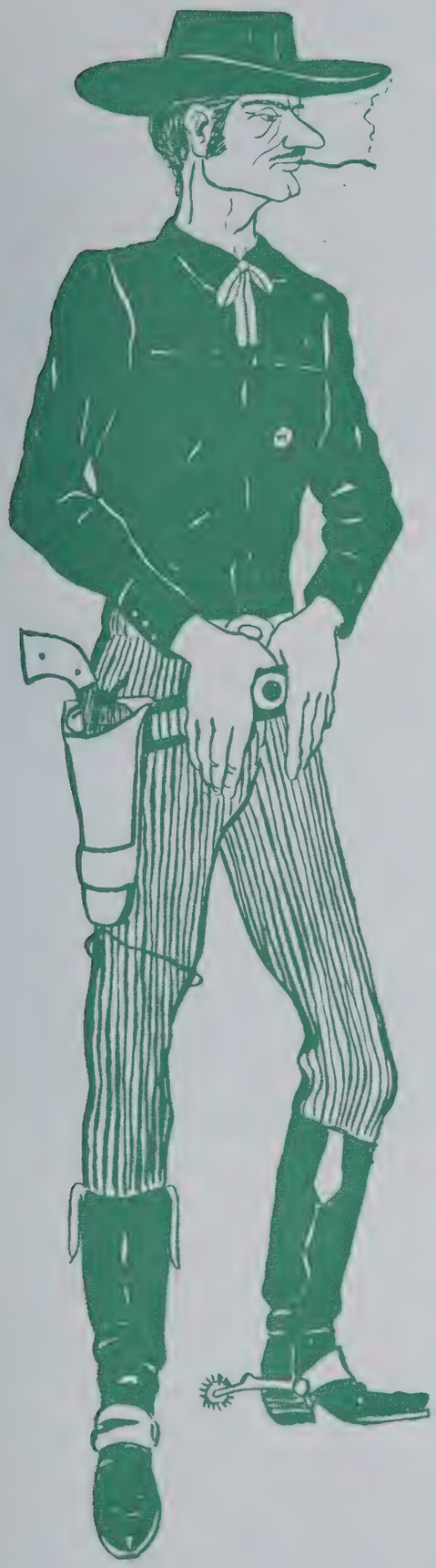
The overhead track facilitates handling of the 50-gallon drums which go from the outside trucking area to the inner sanctum of the volatile solvents storage room. Twelve drums are stored in the fireproof reinforced concrete room. Special panels are a part of the outside walls. If pressure inside the room exceeds twenty pounds per square foot, the panels drop so that any explosion would be directed out-of-doors. Another safety feature visible to the right of the door is the "sniffer," an atmosphere analyzer that turns on the automatic fire nozzles when it doesn't care for the smell of things.

The office wing contains the staff offices (including one for field personnel), a technical library, typing room and message center, and a conference room that doubles as a coffee shop.

The laboratory wing houses six different sections of laboratories where tests are run on concrete, cement, paint, and the asphaltic and bituminous materials. The general warehouse area of the Materials and Tests building is also in this wing, as is the transformer room to which the city of Austin has the only key.

One popular feature of the building is the conference room, with its alias as "coffee shop." The coffee concession is employee-owned and operated, and proceeds go to the flower fund and for athletic equipment. One wall of the conference room, glass, faces an attractive terrace and garden. Curtains for the glass wall and for the doors opposite it are drawn when films are shown in the room.

As always, the coffee room proves to be the get-together point for *all* sections of the handsome new building.



HAVE GUN, WILL SHOOT

Jack V. Light, Designing Engineer
District 4

Every designer of a grade-separation structure at some point in his career faces the choice of obtaining additional right of way, using retaining walls, or using slope paving. The design of the Amarillo Expressway presented the problem.

The first section of the Amarillo Expressway has three overpasses. Cost analyses indicated it was not economically feasible to obtain additional right of way. Another part of the cost factor was maintenance, as past experience indicated that grass slopes greater than two and one-half to one were difficult to maintain. Rainfall in this part of the state is limited, and artificial watering must be relied upon to support vegetation. Therefore, cost of additional right of way and maintenance dictated the choice of using retaining walls. This was done, and has proved satisfactory.

On the next project, however, we had a depressed section which extended 2,200 feet. This posed a different type of problem, but the same three-choice solution.

Additional right of way in this section also proved uneconomical. This left the choice of using retaining walls or slope paving. Money-wise, both of these amounted to about the same. However, in a cut section, the open appearance of slope paving had more advantages than the vertical retaining walls. Slope paving was selected.

A slope of one and one-half to one could be utilized without a great amount of additional right of way. Since this slope is less than the angle of repose of the earth, the only requirement would be something to prevent erosion and still have a pleasing appearance.

Five-inch Class B concrete riprap with a corrugated surface was first selected and included in the plans. On a one and one-half to one slope, difficulty had been encountered in getting an acceptable finish on this type riprap, as it had to be placed extremely dry to keep it from slumping. Some other method of slope paving without this objectionable feature was needed.

Pneumatically placed concrete had been used successfully on swimming pools and grain-storage buildings in this area; so this method was included as the alternate. The strength of pneumatically placed concrete is usually more than twice that of Class B concrete, therefore, a thickness of two and one-half inches was considered adequate.

There were 14,500 square yards of slope paving involved, and both methods were set up on a per-cubic-yard basis with reinforcing included. This meant that a large reduction in quantities could be realized by using the alternate method. All contractors chose the alternate.

Pneumatically placed concrete usually has more than twice the strength of Class B Concrete. Pictured is the unit used for placing the concrete.

The first screed templates are placed following the laying of the wire mesh.

The nozzle man goes to work next, standing on a special platform.

The section used had an eight-inch wide and one-foot deep toe wall at the top. There was an eight-inch wide and one-foot six-inch deep toe wall at the bottom. The reinforcing steel for the toe wall was tied to the wire mesh used in the pneumatically placed concrete. The wire mesh was two inches by two inches by 14/14 in the slab, and three-eighths-inch reinforcing bars at twelve-inch centers were used in the toe walls.

An unusual aspect not encountered in other methods of slope paving was noted. The reinforcing had to be held down, as it tended to float up. Usually, the reinforcing has to be continually pulled up.

At the start, construction joints were to be on 30-foot centers. The contractor thought that he could work

this size section satisfactorily without intermediate control points. We later found that we had to cut to strip shooting of alternate panels, each from six to eight feet in width. The nozzle man shot one panel while the finishers were working on the other. The screeds used were knife edged. This seemed to be the only satisfactory way to accomplish the required results—due to the density of the pneumatically placed concrete.

The screed templates used were three-fourths-inch pipe with three-eighths-inch rod eight inches long welded to these at three centers. These proved useful, as they could be removed easily and placed rapidly at the exact elevations.

Expansion joints were placed at 90-foot joints and consisted of a one-inch redwood board with a one-inch depth of rubber joint filler over it.

The panels averaged 38 feet in length and weep holes were provided at 25-foot intervals. These weep holes were made by inserting a two-inch, grease-coated pipe in the toe wall, the pipe to be removed later. So far, this has proved quite satisfactory.

In the specifications, the design mix was four parts sand and one part cement by volume. The mixer used had a special arrangement made into the skip for exactly four cubic feet of sand, and cement was added ahead of the sand. Mixing included only the sand and cement. Water was added at the nozzle. We used 80 pounds of air pressure on the sand and cement hose, and 110 pounds of pressure on the water line. The water added to this averaged about three gallons per sack. The nozzle man governed the water, and it seemed to be somewhat of a problem. Too much water would let the mixture slump and blow, while too little would cause an excess of rebound. The specifications allowed the use of rebound as aggregate; but the contractor did not elect to do so because of the cost of recovery. We

Alternate panels were shot, allowing finishers to work behind the nozzle man on one panel as he shot the next.

Work progresses, with screed templates still being placed down the line, followed by the nozzleman, with the finishers to the far right.

Alternate panels remain to be shot to finish up the job. Equipment necessary on this job can be seen.

In this view, the end treatment of the pneumatically placed concrete can be seen.

This completed section lies on the south half of the job.

had a loss in rebound of from 15 to 20 per cent.

Experiment with moisture content of the sand proved that very dry sand built up a static electricity annoying to the nozzle man. When too wet, the sand gummed up the machine.

The type of finish we attempted to achieve here was a rubber-float finish. A steel-trowel finish could be accomplished in this type of slope paving, but the glare ruled this out. The finish compared with a textured wall, and worked very well.

Curing was accomplished by the use of a sealing compound, but care had to be exercised to keep the compound out of joints. Where this happened, spalling was in evidence. Where curing compound was not on a joint, the pneumatically placed concrete bonded very well.

Two test cylinders of the pneumatically placed concrete were taken each day. Forms for these test cylinders were standard size, but made from three-fourths-inch square mesh hardware cloth. Strength requirements were for 2,400 pounds per square inch based on a seven-day test, and 4,000 pounds on a 28-day test. So far, all tests were well above this with an average of 4,200 pounds per square inch on seven-day and 5,250 pounds per square inch on 28 days.

An average day's work with the equipment used on this job usually completed approximately 450 square yards. The only equipment needed for pneumatically placed concrete is a mixer, compressor, hose, and nozzle; therefore, the unit is easy to move from one location to another. Mobility of this unit makes it easy to place slope protection on warped sections—a difficult problem with other methods of slope paving.

We do not think that pneumatically placed concrete is by any means a cure-all. There are many places that Class B concrete riprap is preferable; but we do feel that it has its place in the field of highway construction, and we intend to include it as an alternate on some of our future plans.

*Signing Improvement Creates Problems**

K. K. Moore, Supervising Paint Engineer
Materials and Tests Division

Down through the ages, problems have been the constant companion of changes or improvements. With the passing of time our roads have changed from unfenced, unmarked, gutterless trails innocent of grading, gravel, or culverts to the present high-speed, paved, signed, and traffic-striped highways. With these changes have come problems. Predictions for the future indicate an accelerated rate of increase in changes and of problems.

An average of 75,051 gallons of paint per year was used during the four years of 1950 to 1953. During the next four years this average per year increased to 383,780 gallons.

In 1952 the sign shops of the Texas Highway Department produced 91,200 signs. In 1957 production had increased to 151,230 signs. Average cost per sign had increased from $5.46 per sign in 1952 to $8.65 in 1954, and has shown a slight but steady decrease since to the $7.30 per sign in 1957.

A glance at these statistics reveals that one of the problems accompanying changes in signs and striping is cost. We also see that some progress is being made in the solution of this problem. In the face of rising materials and labor costs, the need for bigger signs, and a steady improvement in the quality of our signs, the last three years have shown a steady decrease in the average cost of signs.

Since I believe one can learn from the experience of others, I have made a graph of a few statistics covering the manufacturing industry.

In 1955, average hourly earnings of factory workers were 24 times as high as they were in 1850. Making the corrections necessary for changes in the value of money and the reduction of the work week from 69 hours to 40 hours, the average factory worker can still buy four times as much as could his great-grandfather if he lived in 1850. The obvious question is "What made this amazing advance possible?" The middle curve tells the story. Today's worker produces twice as much as his great-grandfather. Since we all know that we do not work twice as hard as our great-grandfathers, we need a solution other than greater physical effort to account for this increased production. A solution is provided by the bottom curve.

When we realize that capital investment is another way of saying tools, and when we notice that the real increase in production started about 1890, which is just about the time that power-driven machines and im-

SIGNS

YEAR	NUMBER REPLACED OR NEW	TOTAL NUMBER	AVERAGE COST
1952	91,200	207,900	$5.46
1953	116,118	246,558	7.70
1954	107,152	272,393	8.65
1955	121,953	329,346	7.80
1956	131,221	377,316	7.50
1957	151,230	-	7.30

GALLONS TRAFFIC PAINT PURCHASED

AVERAGE PER YEAR 1950-1953	75,051
AVERAGE PER YEAR 1954-1957	383,780

*Speech presented at the Thirty-second Short Course.

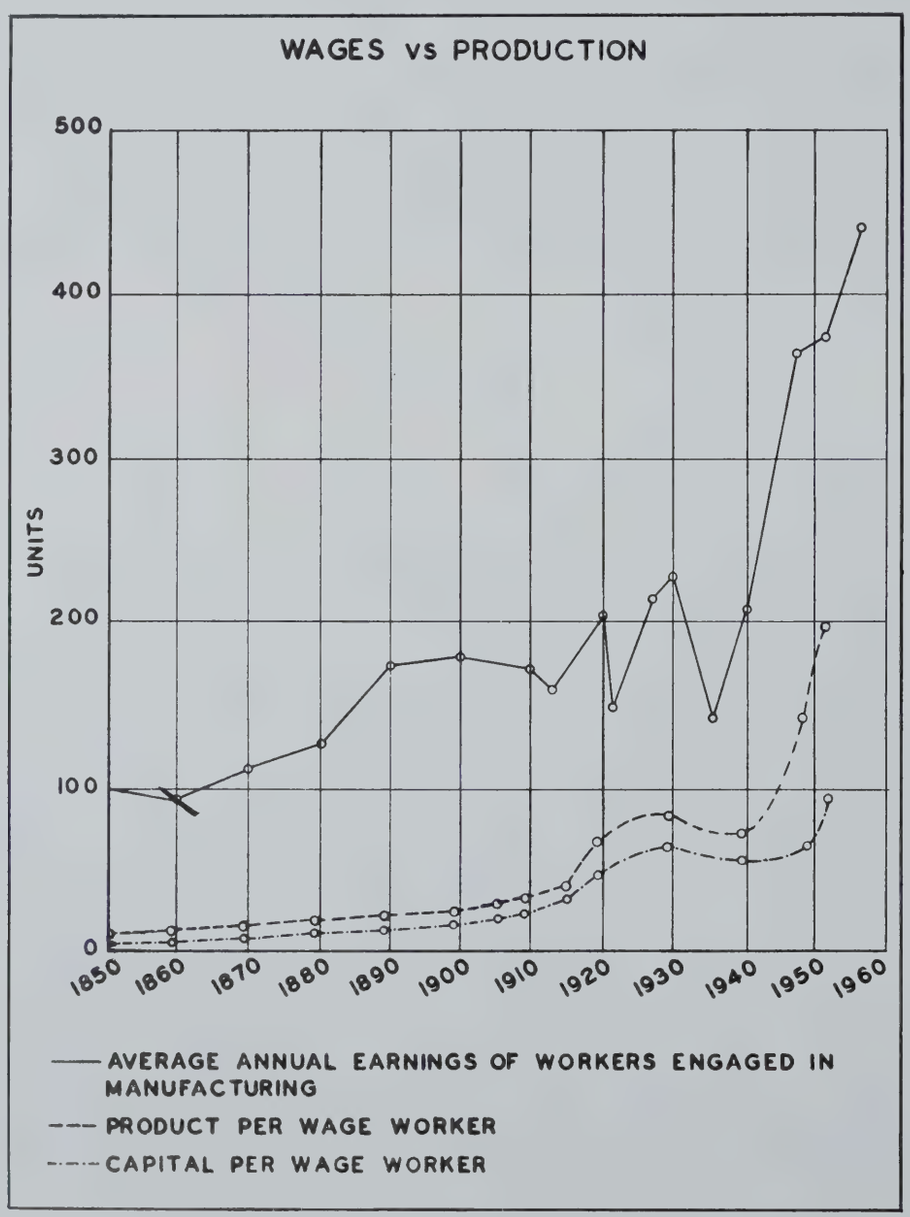
proved production techniques were getting started in this country, we find an obvious answer to the increased production per worker. That answer is modern production methods. This means better equipment and workers with skill and ability to use this improved equipment.

Now, what does all of this have to do with *our* problems? The answer to the Highway Department's problem of more signs, bigger signs, and better signs is better materials and equipment combined with personnel capable of using them profitably.

Better equipment and qualified personnel are the problems of the Districts and Maintenance Operations Division.

But better materials is one of the Materials and Tests Laboratory's problems. I can assure you that every effort is being made to meet this challenge.

Some of the projects now underway at the Laboratory are:



1. A faster drying traffic paint has been developed and will be field tested by the traffic-striping committee this summer. If it gains their approval, it will be supplied to the Districts next spring.

2. Equipment and materials for painting concrete curbs are being investigated. At the present time we would recommend the use of YP-1 instead of YP-7 for curb painting.

3. Development of suitable sign-blank material involves, among other things, the testing of various types of plywood for use as sign blanks. Results of tests to date indicate that medium-density, plastic-faced plywood is our best hope. Also, a great amount of work has gone into the problem of white rust on metal sign blanks. We believe this problem on new signs was solved when Equipment and Procurement Division installed their new method of plating. Our attention is now being directed to this problem on reclaimed signs.

4. Work on WP-3, white exterior paint, continues in two directions. Solution of the seeding problem is our number 1 target. We have reason to hope cautiously that this problem has been solved. The other approach is to revise the formulation of this paint to comply with the expressed desires of the paint-shop personnel. Test results indicate that this may be possible in the near future.

5. YP-1 has served us well, but the adoption of the automatic spray equipment has created problems. Bowing to progress it will be replaced in the near future.

6. Beads and bead binders are still under investigation. A short-course speech by C. B. Hastings will discuss this later.

7. Stencil paste is still a problem and is likely to remain one until sign shop practices become more uniform, and temperatures across the state more stable. Nevertheless we are still striving for improvement.

8. Sign-cleaning detergents are being thoroughly investigated and will be discussed by Hastings.

That briefly is the trend for 1958.

OVER THE HIGHWAYS

Comments . . . from the Traveling Public

When we were traveling in Texas recently my son lost a coat like the material enclosed. It was bought at the Plymouth Clothing Company in St. Joseph, Missouri. It is a large size 42.

It was taken out of the car at a filling station when we left the car for a few minutes or as the car was left while we went in to inquire about a place to stay or taken out along the way. We were careless not to lock the car even while it was in a filling station or in front of an apartment building and have learned an expensive lesson.

We hung it in the car at Austin, Texas, and it was gone on arrival at the place we stayed in Dallas.

Would you ask the Highway Patrol, Highway Maintenance, and Dallas police if such a coat has been found, pawned, etc.? The suit cost $65 and leaves us with two new pair of pants and no coat. It was my son's best suit.

I would be glad to pay postage and a small reward of $10 for its return.

Rella Volker
Highland, Kansas

We live in Texas and were en route to Los Angeles on vacation. We were surprised to find the Highway Travel Information stop and were accepted in a gracious manner and were made proud to know our state offered such a service. The man on duty was most helpful and friendly.

Houston, Texas

We enjoyed a great deal the roadside parks — we breakfasted and lunched at one every day of the seven days en route between Covina, California, and Dallas. A great economical factor which we greatly appreciated and enjoyed.

Covina, California

You've helped to make our vacation more enjoyable and I want to say thanks! Not only are you providing and maintaining the best highways but you have gone the "second mile" and provided wonderful (and beautiful) roadside parks.

My family joins me in this expression of gratitude to your Department for the good work you are doing.

Mrs. Willard L. Thomas
San Angelo, Texas

We recently took a rather extended trip, and of the fifteen states we went through, none could beat the Texas highways.

This is just a note to say thanks. We certainly appreciated the Texas roadside parks and especially those little signs that say "Austin—30," "Austin—15." They are a real help.

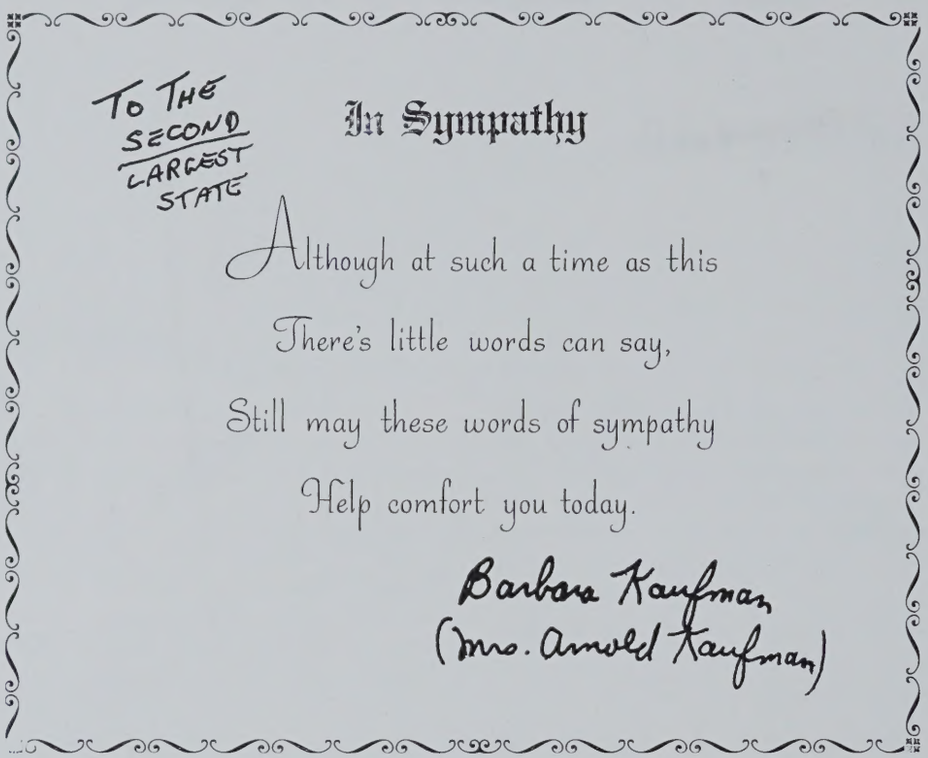
Mary E. Huth
Austin, Texas

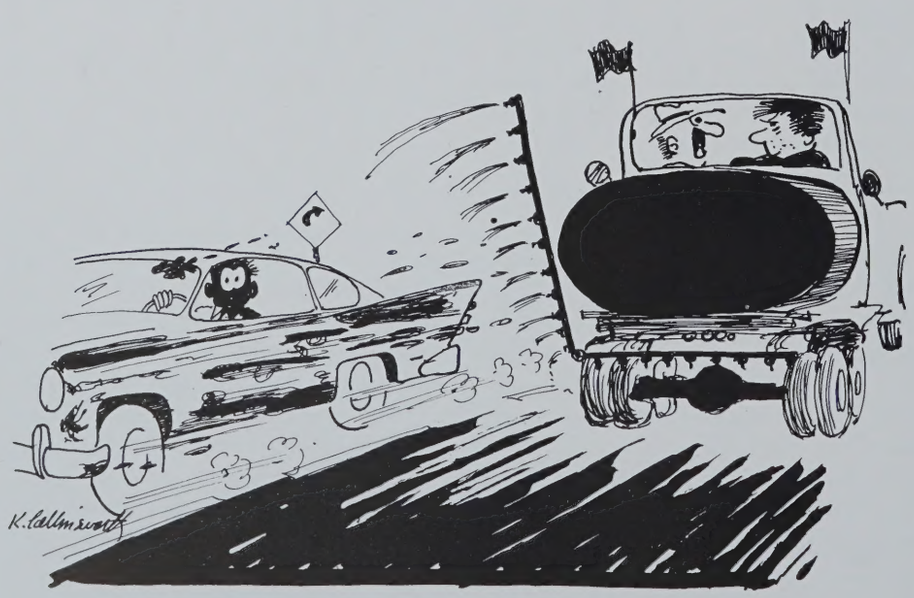
Have returned after almost a month trip to Wyoming. Want to thank you for the wonderful planned road maps. The paper with each town and the number of miles to each was worth its weight in gold. Always knew Texas had the straightest, widest, and safest highways, the cleanest and best graveled roadsides, more and better roadside parks, and good signs. Now I find in your Department the best service in planning travel. Thanks a million.

Mrs. James S. Manning
Georgetown, Texas

To and From Our Readers

A quick-acting Yankee from New York got this card to us almost before the news was out. Texas may have been relegated to second place in size in the nation by the advent of Alaskan statehood, but there are still many biggests and bests that Alaska can't hold a candle to.


TO THE SECOND LARGEST STATE
In Sympathy
Although at such a time as this
There's little words can say,
Still may these words of sympathy
Help comfort you today.
Barbara Kaufman
(Mrs. Arnold Kaufman)



"Too shay."

About the Cover . . .

Pictured on our cover this month is a section of U. S. 80 west of Van Horn on Interstate 10. When we first saw the picture, we decided the Department had come up with some new idea—for what purpose we couldn't decide. Perhaps to break the monotony of West Texas driving—or to keep headlights from glaring at night, or as a safety feature we didn't understand.

A check of the facts disclosed that plain old ordinary economy was the only factor involved. Cost for excavation of this solid rock would have been two to three times that for removal of an equal amount of dirt, and it really was not necessary. Tourists motoring along this stretch will probably think the Department went to extra expense to provide them with something to wonder about.

TEXAS HIGHWAY COMMISSION

MARSHALL FORMBY	**Chairman**
HERBERT C. PETRY JR.	**Member**
CHARLES F. HAWN	**Member**
D. C. GREER	**State Highway Engineer**

Texas Highways

TEXAS HIGHWAYS, official journal of the Texas Highway Department, is published in the interest of highway development in Texas and for departmental education in the improvement of construction, maintenance, and operation.

All material and manuscripts should be directed to the Editorial Office, Division of Information and Statistics, Texas Highway Department, Austin 14, Texas.

This is more of the same stretch of U. S. 80 pictured on the cover. The weird little knobs of rock in the median strip take on the appearance of tents set up for the night.